

INSTITUTE	FACULTY OF ENGINEERING AND TECHNOLOGY
PROGRAM	BACHELOR OF TECHNOLOGY (COMPUTER SCIENCE AND ENGINEERING -CYBER SECURITY)
SEMESTER	3
COURSE TITLE	COMPUTER NETWORK FUNDAMENTALS
COURSE CODE	01CC0302
COURSE CREDITS	4

Objective:

- 1 The objective of this course is to provide students with a solid foundation in data communication by introducing core principles, transmission types, and network classifications. It aims to familiarize students with essential network components, including devices, topologies, and transmission media for both wired and wireless systems. The course equips learners with hands-on skills in configuring, managing, and troubleshooting various types of networks such as LAN, WAN, MAN, and PAN. It also focuses on building a thorough understanding of the OSI and TCP/IP models, associated protocols, and addressing schemes. Additionally, students will gain the ability to design and implement secure networks using firewalls, VPNs, and IDS/IPS, while exploring the functionality of key network protocols and staying updated with emerging networking standards.

Course Outcomes: After completion of this course, student will be able to:

- 1 Apply networking concepts to configure and troubleshoot LAN, WAN, and MAN networks.
- 2 Analyze different network topologies, transmission modes, and media for optimal communication.
- 3 Implement secure network configurations using firewalls, VPNs, and IDS/IPS.
- 4 Evaluate the OSI and TCP/IP models for effective data communication and security.
- 5 Analyze network protocols for data transmission and security in application and transport layers.

Pre-requisite of course: 1. Basic Knowledge of Internet Concepts 2. Basic Understanding of Computer Systems 3. Familiarity with Operating Systems

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	Foundations of Networking: Concepts and Technologies Introduction to Data Communications and Networking, Types of Data Transmission (Analog, Digital, and Hybrid), Networking Devices (Routers, Switches, Hubs, Modems, Gateways), Network Topologies (Bus, Star, Ring, Mesh, Hybrid), Use of Computer Networks, Classification of Networks, LAN Technologies and Standards (Ethernet, Wi-Fi, IEEE 802.3), WAN Connectivity Options (Leased Lines, DSL, Cable, Satellite, Cellular), MAN Infrastructure and Applications (City-wide Networks, Fiber Optics), PAN Devices and Connectivity (Bluetooth, Zigbee, NFC), Virtual Private Networks (VPN Types: Site-to-Site VPN, Remote Access VPN)	9
2	Networking Topologies, Transmission Modes, Media Network Topologies (Bus, Star, Ring, Mesh, Tree, Hybrid) with their features, advantages, and disadvantages, Transmission Modes (Simplex, Half duplex, Full duplex), Transmission Media: Guided Media (Wired): Twisted pair, Coaxial Cable, Fiber Optics, Unguided Media: Radio Waves, Infrared, Microwave, Satellite	8
3	Networking Essentials Switching Devices: Repeaters, Hubs, Switches, Bridges, Routers, Gateways, Multiplexing Techniques: FDM, WDM, TDM, Internet: Internet Service Providers (ISP), Internet Addressing System: Explanation of IP addresses and their classification, IP Address Notation: Understanding IP address formats (IPv4, IPv6) and notation styles	12
4	OSI Model & TCP/IP Protocol Suite OSI Model: Functions of the layers, TCP/IP Protocol Suite, Comparison between OSI and TCP/IP models, Firewalls, Types of Firewalls: Stateful vs. Stateless, Packet Filtering, Proxy Firewalls, Intrusion Detection Systems (IDS) and Intrusion Prevention Systems (IPS), Proxies, Network Security Best Practices	8
5	Network Protocols Introduction to Network Protocols, Definition and Importance of Network Protocols, Standardization Bodies: IETF, IEEE, ITU, Application Layer Protocols: HTTP/HTTPS, FTP/SFTP, SMTP, POP3, IMAP, DNS, Transport Layer Protocols: TCP, UDP, Network Layer Protocols: IP (IPv4, IPv6), ICMP, ARP, Data Link Layer Protocols: Ethernet, PPP, Routing Protocols: RIP, OSPF, BGP	8
Total Hours		45

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Practical 1 Set up a simple LAN network using routers, switches, and PCs to understand basic networking concepts.	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
2	Practical 2 Explore various LAN topologies (bus, star, ring, mesh) using Packet Tracer to understand their advantages and limitations.	2
3	Practical 3 Configure Virtual LANs (VLANs) on switches and set up Inter-VLAN routing to enable communication between VLANs.	2
4	Practical 4 Configure Site-to-Site VPN and Remote Access VPN using routers and VPN protocols (e.g., IPsec, SSL VPN) in Packet Tracer.	2
5	Practical 5 Set up a Wireless LAN (WLAN) using Wi-Fi access points and Bluetooth devices in Packet Tracer to understand wireless networking concepts.	2
6	Practical 6 Implement network security measures such as Access Control Lists (ACLs), firewall rules, and port security on routers and switches in Packet Tracer.	2
7	Practical 7 Simulate common network issues (e.g., connectivity problems, routing errors) in Packet Tracer and use troubleshooting tools to diagnose and resolve them.	2
8	Practical 8 Plan, design, and document a network topology using Packet Tracer, including device configurations, IP addressing schemes, and network diagrams.	2
9	Practical 9 Use Packet Tracer to demonstrate the functions of each layer of the OSI model (Physical, Data Link, Network, Transport, Session, Presentation, Application).	2
10	Practical 10 Configure firewalls (stateful vs. stateless, packet filtering, proxy firewalls) on routers or security appliances in Packet Tracer.	2
11	Practical 11 Set up a simple LAN network using routers, switches, and PCs to understand basic networking concepts.	2
12	Practical 12 Explore various LAN topologies (bus, star, ring, mesh) using Packet Tracer to understand their advantages and limitations.	2
13	Practical 13 Configure Virtual LANs (VLANs) on switches and set up Inter-VLAN routing to enable communication between VLANs.	2
14	Practical 14 Configure Site-to-Site VPN and Remote Access VPN using routers and VPN protocols (e.g., IPsec, SSL VPN) in Packet Tracer.	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
15	Practical 15 Set up a Wireless LAN (WLAN) using Wi-Fi access points and Bluetooth devices in Packet Tracer to understand wireless networking concepts.	2
Total Hours		30

Textbook :

- 1 Computer Networking: A Top-Down Approach, James F. Kurose and Keith W. Ross, Pearson, 2012

References:

- 1 Networking Essentials: A CompTIA Network+ N10-008 Textbook, Networking Essentials: A CompTIA Network+ N10-008 Textbook, Jeff T. Parker, Pearson, 2022
- 2 CCNA Routing and Switching Complete Study Guide: Exam 200-301, CCNA Routing and Switching Complete Study Guide: Exam 200-301, Todd Lammle, -, -

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
10.00	10.00	50.00	20.00	10.00	0.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory or class-room.

Supplementary Resources:

- 1 <https://www.netacad.com/courses/networking-basics?courseLang=en-US>
- 2 https://www.w3schools.com/cybersecurity/cybersecurity_networking.php